

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

GIAVARINI, Francesco  
ABB Ricerca S.p.A.  
Viale Edison, 50  
I-20099 Sesto San Giovanni  
ITALIE

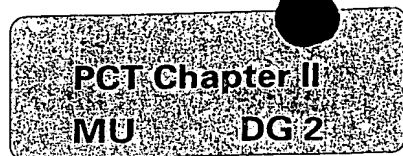
Date of mailing (day/month/year) 18 December 2001 (18.12.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference I-0121-PCT	
International application No. PCT/EP00/08842	International filing date (day/month/year) 04 September 2000 (04.09.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent
<input type="checkbox"/> the common representative		
Name and Address ABB RICERCA S.P.A. Viale Edison, 50 I-20099 Sesto San Giovanni Italy	State of Nationality IT	State of Residence IT
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name	<input checked="" type="checkbox"/> the address
<input type="checkbox"/> the nationality		
<input type="checkbox"/> the residence		
Name and Address ABB SERVICE S.R.L. Via Arconati, 1 I-20135 Milano Italy	State of Nationality IT	State of Residence IT
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Marie-José DEVILLARD
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38



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Sesto San Giovanni, 29.10.2001

EUROPEAN PATENT OFFICE  
International Preliminary Examination Authority

D-80298 Munich



Via facsimile  
Confirmation by special courier

Re.: International Patent Application No. PCT/EP00/08842;  
"Gas-insulated switchgear device";  
filed on 04/09/2000;  
in the name of ABB RICERCA S.p.A et al;  
Our. Ref.: I-0121-PCT.

Dear Sirs:

This is in response to the PCT written opinion pursuant to PCT Rule 66, dated 06.09.2001, concerning the above-referenced International application.

In order to overcome the Examiner's observation under Items V, a set of amended new claims 1 to 14, replacing the claims presently on file, is hereby attached in triplicate.

The new set of Claims meets the requirements of Article 6 PCT.

In accordance with Article 34(2) PCT, no new matter has been introduced. In particular, the subject matter of new claim 1 finds its base on former claims 1 and 6, and on the description (see esp. page 5 lines 12-14); new claims 2-5 substantially reproduces former claims 2-5; new claims 6-14 substantially reproduces former claims 7-15.

ABB Service Srl

ABB Ricerca - Corporate Research Center

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Via Arconati, 1  
20135 Milano  
Web address: [www.abb.com/it](http://www.abb.com/it)

Sede Operativa:  
Viale Edison, 50  
20099 Sesto San Giovanni (MI)  
Tel.: 02/26232.1  
Fax: 02/26232.188

Capitale Sociale: € 516.455 interamente versato  
C.C.I.A.A. Milano n.: 1263494  
Reg. Imp. di Milano n. C.F. iscrizione e P. IVA: 09014870159

With respect to the reasoned statement under Rule 66.2(a)(ii), we would like to point out the following:

#### Novelty

New Claim 1 of the present application relates to a gas-insulated switchgear device, having:

- a first bushing which accommodates a first terminal and a second bushing which accommodates a second terminal;
- a first enclosure which contains an interruption unit; and
- at least one first disconnection unit which has a first fixed contact electrically connected to the interruption unit, a second fixed contact at ground voltage, and a first moving contact which is electrically connected to the first terminal and can be coupled to the first and second fixed contacts, the first moving contact being fixed to a rotary operating element and rotating rigidly therewith, the first and second fixed contacts lying on the rotation plane of the first moving contact itself.

The switchgear device is in particular characterized by the fact that the rotary operating element comprises a shaft made of insulating material which has an end connected to the first terminal so as to support it structurally.

New Claim 1 comprises at least one substantial feature, i. e. the rotary operating element comprising a shaft made of insulating material which has an end connected to the first terminal so as to support it structurally, which is not disclosed in any of the cited documents.

Therefore, in accordance with Article 33(2) PCT, the gas-insulated switchgear device of the present invention is new.

#### Inventive step

As regard to the inventive step, the purpose of the present invention is to realize a gas-insulated switchgear device in which the electrical switching operations occur in a simple and easily controllable way, and has a reduced mechanical complexity and a simplified structure with respect to the devices of the known art (see esp. page 2 lines 7-12).

This purpose is achieved by the combination of features disclosed in new Claim 1. In particular, the fact that the end of the insulating shaft supports structurally the first terminal allows to simplify the structure of the device itself (see page 5 lines 12-14).

Neither document DE-U-29700930 nor document US-A-5796060 suggest the use of the combination of features of the present invention, and in particular the exploitation of the rotary element as an operating element for disconnection and as a structural support for the corresponding terminal at the same time. In no way the person skilled in the art would have been motivated to modify the devices described in the cited prior art so as to achieve the result of the present invention as currently claimed.

Accordingly the gas-insulated switchgear device of the present invention should be considered as involving also an inventive step.

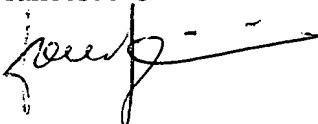
With reference to the Examiner's observation under Item VII, an amended description in conformity with the new claims and taking into account the relevant documents cited will be filed by the applicant as soon as a final version of claims presently on file will be accepted by the Examiner.

As regard to the observation under Rule 6.2(b) PCT, the features of the claims have been provided with reference signs in parenthesis.

With best regards.

The Agent

Francesco Giavarini

A handwritten signature in black ink, appearing to read 'Francesco Giavarini', with a long horizontal stroke extending to the right.

Encl.: Set of claims 1 to 14 (3X)

## CLAIMS

1. A gas-insulated switchgear device, having:

- a first bushing (40) which accommodates a first terminal (2) and a second bushing (41) which accommodates a second terminal (3);

5 - a first enclosure (1) which contains an interruption unit (4); and

- at least one first disconnection unit (100) which has a first fixed contact (96) which is electrically connected to said interruption unit (4), and a second fixed contact (95) at ground voltage, and a first moving contact (94) which is electrically connected to the first terminal (2) and can be coupled to  
10 said first and second fixed contacts (96, 95), said first moving contact (94) being fixed to a rotary operating element (93) and rotating rigidly therewith, the first and second fixed contacts (96, 95) lying on the rotation plane of said first moving contact (94), characterized in that said rotary operating element (93) comprises a shaft made of insulating material, said shaft having an end  
15 which is connected to the first terminal (2) and being suitable to support it structurally.

2. The switchgear device according to claim 1, characterized in that said first disconnection unit (100) comprises an enclosure (99) which has a substantially spheroidal central portion and two mutually opposite ends (97, 98) which are structurally connected respectively to said first enclosure (1) and to said first bushing (40).  
20

3. The switchgear device according to claim 2, characterized in that said second fixed contact (95) at ground voltage is arranged on the spheroidal portion.

25 4. The switchgear device according to claim 1, characterized in that the first moving contact (94) is constituted by a blade which is keyed on said operating element (93) and is substantially perpendicular to its rotation axis.

5. The switchgear device according to one or more of the preceding claims, characterized in that said first moving contact (94) can be turned between a

first position for coupling to the first fixed contact (96) and a second position for coupling to the second fixed contact (95), the rotation angle between the first position and the second position being between  $30^\circ$  and  $150^\circ$ , preferably between  $60^\circ$  and  $120^\circ$ , more preferably between  $80^\circ$  and  $100^\circ$ .

- 5 6. The switchgear device according to claim 1, characterized in that it comprises a second disconnection unit (5) which is arranged inside said first enclosure (1) and comprises a third fixed contact (6, 21) which is connected to the second terminal (3) and a fourth fixed contact (7, 22) which is at ground voltage, at least one second moving contact (10) which can be  
10 coupled to at least one of said third and fourth fixed contacts (6, 7, 21, 22) and is electrically connected to said interruption unit (4), said second moving contact (10) being fixed to a second rotary operating element (8) and rotating rigidly therewith, the fixed contact (6, 7, 21, 22) that can be coupled to said second moving contact (10) being arranged on the rotation plane of  
15 said second moving contact (10).
7. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a single moving contact (10) and in that said third and fourth fixed contacts (6, 7) lie on the rotation plane of the moving contact (10).
- 20 8. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a second moving contact (10) and a third moving contact which are fixed to said second operating element (8), and in that said third and fourth fixed contacts (6, 7) lie respectively on the rotation plane of said second and third moving contacts, which are fixed to  
25 said second operating element (8) in a relative angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said third and fourth fixed contacts (6, 7).
9. The switchgear device according to one or more of claims 6-8, characterized in that it comprises a third bushing (43) which accommodates a third

terminal (13) and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31) and a third moving contact (32) which are fixed to the second operating element (8), said third and fourth fixed contacts (21, 22) being arranged on the rotation plane of said second moving contact (31), the fifth fixed contact (23) being arranged on the rotation plane of said third moving contact (32), the second and third moving contacts (31, 32) being fixed to the second operating element (8) in a mutual angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said fourth and fifth fixed contacts (22, 23).

10. The switchgear device according to one or more of claims 1 to 8, characterized in that it comprises a third bushing (43) which accommodates a third terminal (13), and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31), a third moving contact (32) and a fourth moving contact (33) which are fixed to the second operating element (8), the third, fourth and fifth fixed contacts (21, 22, 23) being arranged respectively on the rotation plane of the second, third and fourth moving contacts (31, 32, 33), said moving contacts (31, 32, 33) being fixed to the operating element (8) in a mutual angular arrangement by virtue of which the third moving contact (32) cannot be coupled to the fourth fixed contact (22) when the second and/or fourth moving contacts (31, 33) are coupled to the corresponding fixed contacts (21, 23).

11. The switchgear device according to one or more of claims 7 to 10, characterized in that at least one of the moving contacts (31, 32, 33) that belong to the second disconnection unit (5) is constituted by a blade which is keyed on the second operating element (8) and is substantially perpendicular to the rotation axis of said second operating element (8).

12. The switchgear device according to one or more of the preceding claims,  
characterized in that the interruption unit (4) comprises an interruption  
chamber which accommodates a fixed contact (14) and a moving contact  
(15), the longitudinal axis of said chamber being substantially aligned with  
5 the rotation axis of the second operating element (8).
13. The switchgear device according to claim 12, characterized in that the  
enclosure of said interruption chamber constitutes the second operating  
element.
14. The switchgear device according to one or more of the preceding claims,  
10 characterized in that the rotary operating element (93, 8) of the first and/or  
the second disconnection units (100, 5) are actuated by an electric rotary  
servomotor.

# PATENT COOPERATION TREATY

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From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

To:

GIAVARINI, Francesco  
ABB RICERCA SPA  
Viale Edison, 50  
I-20099 Sesto San Giovanni (MI)  
ITALIE

### NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence  
and Administrative Instructions, Section 601(a))

Date of mailing  
(day/month/year)

24.04.01

Applicant's or agent's file reference

I-0121-PCT

#### IMPORTANT NOTIFICATION

International application No.

PCT/EP 00/ 08842

International filing date (day/month/year)

04/09/2000

Priority date (day/month/year)

15/09/1999

Applicant

ABB RICERCA S.P.A. et al.

1. The applicant is hereby **notified** that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

04/04/2001

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/

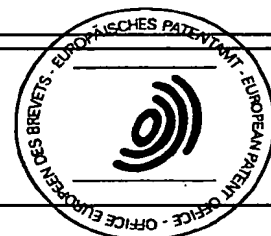


European Patent Office  
D-80298 Munich  
Tel. (+49-89) 2399-0, Tx: 523656 epmu d  
Fax: (+49-89) 2399-4465

Authorized officer

KENNEDY M B

Tel. (+49-89) 2399-2976



JMM

## PATENT COOPERATION TREATY

12

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

GIAVARINI, Francesco  
ABB RICERCA SPA  
Viale Edison, 50  
I-20099 Sesto San Giovanni (MI)  
ITALIE

WRITTEN OPINION

(PCT Rule 66)

Date of mailing  
(day/month/year)

0 6. 09. 01

Applicant's or agent's file reference

I-0121-PCT

REPLY DUE

within 2 months/days  
from the above date of mailing

International application No.

PCT/EP 00/08842

International filing date (day/month/year)

04/09/2000

Priority date (day/month/year)

15/09/1999

International Patent Classification (IPC) or both national classification and IPC

H02B13/035

Applicant

ABB RICERCA S.P.A. et al.

1. This written opinion is the first (first, etc.) drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion  
 II ☐ Priority  
 III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  
 IV ☐ Lack of unity of invention  
 V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement  
 VI ☐ Certain documents cited  
 VII ☒ Certain defects in the international application  
 VIII ☐ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also** For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis. For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 15/01/2002

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. (+49-89) 2399-0, Tx: 523656 epmu d  
Fax: (+49-89) 2399-4465

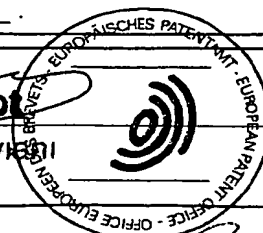
Authorized officer

Examiner

C. Bournon

Formalities officer  
(incl. extension of time limits)

Paola Ottaviani



Scat. h. 5  
06.09.01/AB

Signature

## WRITTEN OPINION

## I. Basis of the opinion

1. This opinion has been drawn up on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☒ the international application as originally filed

☐ the description, pages

,as originally filed

pages

,filed with the demand

pages

, filed with the letter of

☐ the claims Nos.

,as originally filed

Nos.

,as amended under Article 19

Nos.

, filed with the demand

Nos.

, filed with the letter of

☐ the drawings, sheets / fig.

,as originally filed

sheets / fig.

, filed with the demand

sheets / fig.

, filed with the letter of

2. The amendments have resulted in the cancellation of:

☐ the description, pages:

☐ the claims, Nos.

☐ the drawings, sheets / fig.

3. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2 (c)).

4. Additional observations, if necessary:

## WRITTEN OPINION

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Claims	1
	Claims	
Inventive Step	Claims	2-15
	Claims	
Industrial Applicability	Claims	
	Claims	

2. Citations and Explanations

- I. Document DE-U-29700930 discloses a gas-insulated switchgear device comprising all the features of claim 1 so that the subject-matter of claim 1 is not new (Article 33(2) PCT).

In particular, the known switchgear device comprises a first fixed contact which is electrically connected to an interruption unit and a second fixed contact at ground voltage, a moving contact (12, 13) which is electrical<sup>✓</sup> connected to a first terminal (5) and can be coupled to said first and second fixed contacts, said moving contact (12, 13) being fixed to a rotary operating element (7) and rotating rigidly therewith, and in that the fixed contacts that can be coupled to said first moving contact lie on the rotation plane of said moving contact. (See Figure and corresponding description).

The applicant's attention is also drawn to document US-A-5 796 060 (Figure 6) which also discloses a switchgear device comprising the main features of claim 1.

- II. Dependent claims 2-15 contain either features which directly derive from the above considered documents, or features which appear obvious to one skilled in the art. Therefore, these dependent claims do not involve an inventive step (Article 33(3) PCT).

**WRITTEN OPINION**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

The applicant is therefore invited to file a new set of claims.

The technical features mentioned in both part of the claims shall be followed by reference signs placed between parentheses Rule 6.2(b) PCT).

The introductory part of the description should be amended to correspond to the matter claimed and to acknowledge in suitable terms the most pertinent prior art as required by Rule 5.1(a), (ii) PCT: this should apparently include the documents DE-U-29700930 and US-A-5796060.

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

# PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR THE DECLARATION

(PCT Rule 44.1)

To:

ABB RICERCA SPA  
Attn. GIAVARINI, Francesco  
Viale Edison, 50  
I-20099 Sesto San Giovanni (MI)  
ITALY

Date of mailing  
(day/month/year)

03/01/2001

Applicant's or agent's file reference

I-0121-PCT

**FOR FURTHER ACTION**

See paragraphs 1 and 4 below

International application No.

PCT/EP 00/08842

International filing date  
(day/month/year)

04/09/2000

Applicant

ABB RICERCA S.P.A. et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

**Where?** Directly to the International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90b/s.1 and 90b/s.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Jacobus Constant

3/1/11

# PATENT COOPERATION TREATY

DeS,

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From the RECEIVING OFFICE

PCT

To:

Giavarini, Francesco  
ABB RICERCA SPA  
Viale Edison, 50  
I-20099 Sesto San Giovanni (MI)  
ITALIE

NOTIFICATION OF THE INTERNATIONAL  
APPLICATION NUMBER AND OF THE  
INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

Date of mailing  
(day/month/year)

23. 10. 2000

Applicant's or agent's file reference

I-0121-PCT

IMPORTANT NOTIFICATION

International application No.

PCT/EP 00/ 08842

International filing date (day/month/year)

04/09/2000

Priority date (day/month/year)

15/09/1999

Applicant

ABB RICERCA S.P.A.

Title of the invention

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.
2. The applicant is further notified that the record copy of the international application was transmitted to the International Bureau on the above date of mailing.

3. ☐ Other:

\* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

Name and mailing address of the receiving Office



European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

R.L.R. PETHER

9/30/10

## PATENT COOPERATION TREATY

8

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION CONCERNING  
SUBMISSION OR TRANSMITTAL  
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

GIAVARINI, Francesco  
ABB Ricerca S.p.A.  
Viale Edison, 50  
I-20099 Sesto San Giovanni  
ITALIE

Date of mailing (day/month/year) 10 January 2001 (10.01.01)	<b>IMPORTANT NOTIFICATION</b>
Applicant's or agent's file reference I-0121-PCT	
International application No. PCT/EP00/08842	
International publication date (day/month/year) Not yet published	
International filing date (day/month/year) 04 September 2000 (04.09.00)	Priority date (day/month/year) 15 September 1999 (15.09.99)
Applicant ABB RICERCA S.P.A. et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(\*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
15 Sept 1999 (15.09.99)	MI99A001923	IT	28 Dec 2000 (28.12.00)

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

C. Cupello

*Cupello*

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38

Q 13/11

# PATENT COOPERATION TREATY

14

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

To:

GIAVARINI, Francesco  
ABB RICERCA SPA  
Viale Edison, 50  
I-20099 Sesto San Giovanni (MI)  
ITALIE

### NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing  
(day/month/year)

27. 11. 01

Applicant's or agent's file reference  
I-0121-PCT

#### IMPORTANT NOTIFICATION

International application No.

PCT/EP 00/ 08842

International filing date (day/month/year)

04/09/2000

Priority date (day/month/year)

15/09/1999

Applicant

ABB RICERCA S.P.A. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

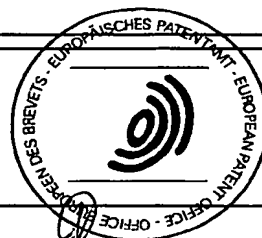
Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. (+49-89) 2399-0, Tx: 523656 epmu d  
Fax: (+49-89) 2399-4465

Authorized officer

Paola Ottaviani



## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT


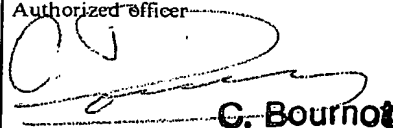

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>I-0121-PCT</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/EP 00/ 08842</b>	International filing date ( <i>day/month/year</i> ) <b>04/09/2000</b>	Priority date ( <i>day/month/year</i> ) <b>15/09/1999</b>
International Patent Classification (IPC) or national classification and IPC <b>H02B13/035</b>		
Applicant <b>ABB RICERCA S.P.A. et al.</b>		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This **REPORT** consists of a total of 5 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consists of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand <b>04/04/2001</b>	Date of completion of this report <b>27. 11. 01</b>
Name and mailing address of the IPEA/  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer  <b>C. Bournois</b> 

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

## I. Basis of the report

1. This report has been drawn up on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*

☐ the international application as originally filed

☒ the description, pages 1-11, as originally filed  
 pages, filed with the demand  
 pages, filed with the letter of

☒ the claims, Nos. , as originally filed  
 Nos. , as amended under Article 19  
 Nos. , filed with the demand  
 Nos. 1-14, filed with the letter of 29.10.01

☒ the drawings, sheets / fig. 1/5 - 5/5, as originally filed  
 sheets / fig. , filed with the demand  
 sheets / fig. , filed with the letter of

2. The amendments have resulted in the cancellation of:

☐ the description, pages:  
☐ the claims, Nos.  
☐ the drawings, sheets / fig.

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2 (c)).

4. Additional observations, if necessary:

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty	Claims	1-14	YES
	Claims		NO
Inventive Step	Claims	1-14	YES
	Claims		NO
Industrial Applicability	Claims	1-14	YES
	Claims		NO

## 2. Citations and Explanations

Claim 1

N, IS: Document DE-U-29 700 930 (closest prior art) discloses a gas-insulated switchgear device according to the preamble of claim 1.

The subject-matter of claim 1 differs from document DE-U-29 700 930 especially in that the rotary operating element comprises a shaft made of insulating material, said shaft having an end which is connected to the first terminal and being suitable to support it structurally.

Document US-A-5 796 060 does not disclose the features of the new claimed gas-insulated switchgear device.

Therefore, in the light of document DE-U-29 700 930 or US-A-5 796 060 the subject-matter of claim 1 is novel (Article 33(2) PCT) and with respect to the aim of the invention (see page 2, lines 7-12), involves an inventive step (Article 33(3) PCT).

The dependent claims 2-14 are concerned with further embodiments of the subject-matter of claim 1 and would satisfy the requirements of the PCT.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

IA: The invention specified in the claims is clearly susceptible of industrial application in the sense of Article 33(4) PCT.

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

1. The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents DE-U-29 700 930 and US-A-5 796 060 is not mentioned in the description, nor are these documents identified therein.

## CLAIMS

1. A gas-insulated switchgear device, having:

- a first bushing (40) which accommodates a first terminal (2) and a second bushing (41) which accommodates a second terminal (3);

- a first enclosure (1) which contains an interruption unit (4); and

- at least one first disconnection unit (100) which has a first fixed contact (96) which is electrically connected to said interruption unit (4), and a second fixed contact (95) at ground voltage, and a first moving contact (94) which is electrically connected to the first terminal (2) and can be coupled to said first and second fixed contacts (96, 95), said first moving contact (94) being fixed to a rotary operating element (93) and rotating rigidly therewith, the first and second fixed contacts (96, 95) lying on the rotation plane of said first moving contact (94), characterized in that said rotary operating element (93) comprises a shaft made of insulating material, said shaft having an end which is connected to the first terminal (2) and being suitable to support it structurally.

2. The switchgear device according to claim 1, characterized in that said first disconnection unit (100) comprises an enclosure (99) which has a substantially spheroidal central portion and two mutually opposite ends (97, 98) which are structurally connected respectively to said first enclosure (1) and to said first bushing (40).

3. The switchgear device according to claim 2, characterized in that said second fixed contact (95) at ground voltage is arranged on the spheroidal portion.

4. The switchgear device according to claim 1, characterized in that the first moving contact (94) is constituted by a blade which is keyed on said operating element (93) and is substantially perpendicular to its rotation axis.

5. The switchgear device according to one or more of the preceding claims, characterized in that said first moving contact (94) can be turned between a

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29-10-2001

first position for coupling to the first fixed contact (96) and a second position for coupling to the second fixed contact (95), the rotation angle between the first position and the second position being between  $30^\circ$  and  $150^\circ$ , preferably between  $60^\circ$  and  $120^\circ$ , more preferably between  $80^\circ$  and  $100^\circ$ .

5 6. The switchgear device according to claim 1, characterized in that it comprises a second disconnection unit (5) which is arranged inside said first enclosure (1) and comprises a third fixed contact (6, 21) which is connected to the second terminal (3) and a fourth fixed contact (7, 22) which is at ground voltage, at least one second moving contact (10) which can be  
10 coupled to at least one of said third and fourth fixed contacts (6, 7, 21, 22) and is electrically connected to said interruption unit (4), said second moving contact (10) being fixed to a second rotary operating element (8) and rotating rigidly therewith, the fixed contact (6, 7, 21, 22) that can be coupled to said second moving contact (10) being arranged on the rotation plane of  
15 said second moving contact (10).

7. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a single moving contact (10) and in that said third and fourth fixed contacts (6, 7) lie on the rotation plane of the moving contact (10).

20 8. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a second moving contact (10) and a third moving contact which are fixed to said second operating element (8), and in that said third and fourth fixed contacts (6, 7) lie respectively on the rotation plane of said second and third moving contacts, which are fixed to  
25 said second operating element (8) in a relative angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said third and fourth fixed contacts (6, 7).

9. The switchgear device according to one or more of claims 6-8, characterized in that it comprises a third bushing (43) which accommodates a third

AMENDED SHEET

terminal (13) and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31) and a third moving contact (32) which are fixed to the second operating element (8), said third and fourth fixed contacts (21, 22) being arranged on the rotation plane of said second moving contact (31), the fifth fixed contact (23) being arranged on the rotation plane of said third moving contact (32), the second and third moving contacts (31, 32) being fixed to the second operating element (8) in a mutual angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said fourth and fifth fixed contacts (22, 23).

10. The switchgear device according to one or more of claims 1 to 8, characterized in that it comprises a third bushing (43) which accommodates a third terminal (13), and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31), a third moving contact (32) and a fourth moving contact (33) which are fixed to the second operating element (8), the third, fourth and fifth fixed contacts (21, 22, 23) being arranged respectively on the rotation plane of the second, third and fourth moving contacts (31, 32, 33), said moving contacts (31, 32, 33) being fixed to the operating element (8) in a mutual angular arrangement by virtue of which the third moving contact (32) cannot be coupled to the fourth fixed contact (22) when the second and/or fourth moving contacts (31, 33) are coupled to the corresponding fixed contacts (21, 23).

11. The switchgear device according to one or more of claims 7 to 10, characterized in that at least one of the moving contacts (31, 32, 33) that belong to the second disconnection unit (5) is constituted by a blade which is keyed on the second operating element (8) and is substantially perpendicular to the rotation axis of said second operating element (8).

AMENDED SHEET

12. The switchgear device according to one or more of the preceding claims,  
characterized in that the interruption unit (4) comprises an interruption  
chamber which accommodates a fixed contact (14) and a moving contact  
(15), the longitudinal axis of said chamber being substantially aligned with  
5 the rotation axis of the second operating element (8).
13. The switchgear device according to claim 12, characterized in that the  
enclosure of said interruption chamber constitutes the second operating  
element.
14. The switchgear device according to one or more of the preceding claims,  
10 characterized in that the rotary operating element (93, 8) of the first and/or  
the second disconnection units (100, 5) are actuated by an electric rotary  
servomotor.

AMENDED SHEET

## PATENT COOPERATION TREATY

15

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

GIAVARINI, Francesco  
ABB Ricerca S.p.A.  
Viale Edison, 50  
I-20099 Sesto San Giovanni  
ITALIE

Date of mailing (day/month/year) 18 December 2001 (18.12.01)	<b>IMPORTANT NOTIFICATION</b>
Applicant's or agent's file reference I-0121-PCT	
International application No. PCT/EP00/08842	International filing date (day/month/year) 04 September 2000 (04.09.00)

## 1. The following indications appeared on record concerning:

☒ the applicant    ☐ the inventor    ☐ the agent    ☐ the common representative

## Name and Address

ABB RICERCA S.P.A.  
Viale Edison, 50  
I-20099 Sesto San Giovanni  
Italy

## State of Nationality

IT

## State of Residence

IT

Telephone No.

Facsimile No.

Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person    ☒ the name    ☒ the address    ☐ the nationality    ☐ the residence

## Name and Address

ABB SERVICE S.R.L.  
Via Arconati, 1  
I-20135 Milano  
Italy

## State of Nationality

IT

## State of Residence

IT

Telephone No.

Facsimile No.

Teleprinter No.

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Marie-José DEVILLARD

Telephone No.: (41-22) 338.83.38

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) I-0121-PCT

Box No. I TITLE OF INVENTION

GAS-INSULATED SWITCHGEAR DEVICE

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ABB RICERCA S.p.A.  
VIALE EDISON, 50  
I-20099 SESTO SAN GIOVANI (MI)  
ITALY

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

IT

State (that is, country) of residence:

IT

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

PIAZZA COSTANTE  
VIA MARZAGALLI, 18  
I-26900 LODI  
ITALY

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

IT

State (that is, country) of residence:

IT

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

GIAVARINI FRANCESCO  
ABB RICERCA S.p.A.  
VIALE EDISON, 50  
I-20099 SESTO SAN GIOVANNI (MI)  
ITALY

Telephone No.

+39 02 26232182

Facsimile No.

+39 02 26232188

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

## Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

*If none of the following sub-boxes is used, this sheet should not be included in the request.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SFONDRINI LIBERO  
VIALE IV NOVEMBRE 25  
I-26900 LODI  
ITALY

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
IT

State (that is, country) of residence:  
IT

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SCIACCA ALDO  
VIA 1° MAGGIO 7/B  
I-20097 SAN DONATO MILANESE (MI)  
ITALY

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
IT

State (that is, country) of residence:  
IT

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

☐ applicant only

☐ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

☐ applicant only

☐ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

**Box No.V DESIGNATION OF STATES**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....

**National Patent** (if other kind of protection or treatment desired, specify on dotted line):

- |  |   |
|--|---|
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| <input type="checkbox"/> AG Antigua and Barbuda                                    | <input type="checkbox"/> LK Sri Lanka                                       |
| <input checked="" type="checkbox"/> AL Albania .....                               | <input type="checkbox"/> LR Liberia   |
| <input type="checkbox"/> AM Armenia .....  | <input type="checkbox"/> LS Lesotho .....                                   |
| <input type="checkbox"/> AT Austria .....  | <input type="checkbox"/> LT Lithuania                                       |
| <input checked="" type="checkbox"/> AU Australia .....                             | <input type="checkbox"/> LU Luxembourg                                      |
| <input type="checkbox"/> AZ Azerbaijan   | <input type="checkbox"/> LV Latvia  |
| <input type="checkbox"/> BA Bosnia and Herzegovina .....                           | <input type="checkbox"/> MA Morocco .....                                   |
| <input type="checkbox"/> BB Barbados   | <input type="checkbox"/> MD Republic of Moldova .....                       |
| <input checked="" type="checkbox"/> BG Bulgaria .....                              | <input type="checkbox"/> MG Madagascar .....                                |
| <input checked="" type="checkbox"/> BR Brazil .....                                | <input type="checkbox"/> MK The former Yugoslav Republic of Macedonia ..... |
| <input type="checkbox"/> BY Belarus .....  | <input type="checkbox"/> MN Mongolia  |
| <input type="checkbox"/> BZ Belize   | <input type="checkbox"/> MW Malawi .....                                    |
| <input checked="" type="checkbox"/> CA Canada                                      | <input checked="" type="checkbox"/> MX Mexico .....                         |
| <input type="checkbox"/> CH and LI Switzerland and Liechtenstein                   | <input type="checkbox"/> MZ Mozambique                                      |
| <input checked="" type="checkbox"/> CN China .....                                 | <input checked="" type="checkbox"/> NO Norway                               |
| <input type="checkbox"/> CR Costa Rica .....                                       | <input checked="" type="checkbox"/> NZ New Zealand .....                    |
| <input type="checkbox"/> CU Cuba .....   | <input checked="" type="checkbox"/> PL Poland .....                         |
| <input checked="" type="checkbox"/> CZ Czech Republic                              | <input type="checkbox"/> PT Portugal  |
| <input type="checkbox"/> DE Germany .....  | <input type="checkbox"/> RO Romania   |
| <input type="checkbox"/> DK Denmark .....  | <input type="checkbox"/> RU Russian Federation .....                        |
| <input type="checkbox"/> DM Dominica   | <input type="checkbox"/> SD Sudan   |
| <input type="checkbox"/> DZ Algeria .....  | <input type="checkbox"/> SE Sweden  |
| <input type="checkbox"/> EE Estonia .....  | <input type="checkbox"/> SG Singapore                                       |
| <input type="checkbox"/> ES Spain .....  | <input checked="" type="checkbox"/> SI Slovenia .....                       |
| <input type="checkbox"/> FI Finland .....  | <input type="checkbox"/> SK Slovakia .....                                  |
| <input type="checkbox"/> GB United Kingdom   | <input type="checkbox"/> SL Sierra Leone .....                              |
| <input type="checkbox"/> GD Grenada  | <input type="checkbox"/> TJ Tajikistan                                      |
| <input type="checkbox"/> GE Georgia .....  | <input type="checkbox"/> TM Turkmenistan                                    |
| <input type="checkbox"/> GH Ghana .....  | <input checked="" type="checkbox"/> TR Turkey .....                         |
| <input type="checkbox"/> GM Gambia   | <input type="checkbox"/> TT Trinidad and Tobago .....                       |
| <input checked="" type="checkbox"/> HR Croatia .....                               | <input type="checkbox"/> TZ United Republic of Tanzania                     |
| <input checked="" type="checkbox"/> HU Hungary .....                               | <input checked="" type="checkbox"/> UA Ukraine .....                        |
| <input type="checkbox"/> ID Indonesia  | <input type="checkbox"/> UG Uganda .....                                    |
| <input checked="" type="checkbox"/> IL Israel .....                                | <input checked="" type="checkbox"/> US United States of America .....       |
| <input checked="" type="checkbox"/> IN India .....                                 | <input type="checkbox"/> UZ Uzbekistan .....                                |
| <input type="checkbox"/> IS Iceland  | <input type="checkbox"/> VN Viet Nam .....                                  |
| <input checked="" type="checkbox"/> JP Japan .....                                 | <input checked="" type="checkbox"/> YU Yugoslavia .....                     |
| <input type="checkbox"/> KE Kenya .....  | <input type="checkbox"/> ZA South Africa .....                              |
| <input type="checkbox"/> KG Kyrgyzstan .....                                       | <input type="checkbox"/> ZW Zimbabwe .....                                  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea ..... |   |
| <input checked="" type="checkbox"/> KR Republic of Korea .....                     |   |
| <input type="checkbox"/> KZ Kazakhstan .....                                       |   |

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<b>Box No. VI PRIORITY CLAIM</b>		<input type="checkbox"/> Further claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 15 September 1999 (15.09.99)	MI99A001923	IT		
item (2)				
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This international application contains the following number of sheets:

request : 4  
description (excluding sequence listing part) : 11  
claims : 4  
abstract : 1  
drawings : 5  
sequence listing part of description : /

Total number of sheets : 25

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
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4. ☐ statement explaining lack of signature
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1

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Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

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## CLAIMS

1. A gas-insulated switchgear device, having:
  - a first bushing (40) which accommodates a first terminal (2) and a second bushing (41) which accommodates a second terminal (3);
  - 5       - a first enclosure (1) which contains an interruption unit (4); and
  - at least one first disconnection unit (100) which has a first fixed contact (96) which is electrically connected to said interruption unit (4), and a second fixed contact (95) at ground voltage, and a first moving contact (94) which is electrically connected to the first terminal (2) and
  - 10       can be coupled to said first and second fixed contacts (96, 95), said first moving contact (94) being fixed to a rotary operating element (93) and rotating rigidly therewith, the first and second fixed contacts (96, 95) lying on the rotation plane of said first moving contact (94), characterized in that said rotary operating element (93) comprises a shaft
  - 15       made of insulating material, said shaft having an end which is connected to the first terminal (2) and being suitable to support it structurally.
2. The switchgear device according to claim 1, characterized in that said first disconnection unit (100) comprises an enclosure (99) which has a substantially spheroidal central portion and two mutually opposite ends
- 20       (97, 98) which are structurally connected respectively to said first enclosure (1) and to said first bushing (40).
3. The switchgear device according to claim 2, characterized in that said second fixed contact (95) at ground voltage is arranged on the spheroidal portion.
- 25   4. The switchgear device according to claim 1, characterized in that the first moving contact (94) is constituted by a blade which is keyed on said operating element (93) and is substantially perpendicular to its rotation axis.
5. The switchgear device according to one or more of the preceding claims,
- 30       characterized in that said first moving contact (94) can be turned

between a first position for coupling to the first fixed contact (96) and a second position for coupling to the second fixed contact (95), the rotation angle between the first position and the second position being between  $30^{\circ}$  and  $150^{\circ}$ , preferably between  $60^{\circ}$  and  $120^{\circ}$ , more preferably between  $80^{\circ}$  and  $100^{\circ}$ .

6. The switchgear device according to claim 1, characterized in that it comprises a second disconnection unit (5) which is arranged inside said first enclosure (1) and comprises a third fixed contact (6, 21) which is connected to the second terminal (3) and a fourth fixed contact (7, 22) which is at ground voltage, at least one second moving contact (10) which can be coupled to at least one of said third and fourth fixed contacts (6, 7, 21, 22) and is electrically connected to said interruption unit (4), said second moving contact (10) being fixed to a second rotary operating element (8) and rotating rigidly therewith, the fixed contact (6, 7, 21, 22) that can be coupled to said second moving contact (10) being arranged on the rotation plane of said second moving contact (10).
7. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a single moving contact (10) and in that said third and fourth fixed contacts (6, 7) lie on the rotation plane of the moving contact (10).
8. The switchgear device according to claim 6, characterized in that said second disconnection unit (5) comprises a second moving contact (10) and a third moving contact which are fixed to said second operating element (8), and in that said third and fourth fixed contacts (6, 7) lie respectively on the rotation plane of said second and third moving contacts, which are fixed to said second operating element (8) in a relative angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said third and fourth fixed contacts (6, 7).
9. The switchgear device according to one or more of claims 6-8,

characterized in that it comprises a third bushing (43) which accommodates a third terminal (13) and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31) and a third moving contact (32) which are fixed to the second operating element (8), said third and fourth fixed contacts (21, 22) being arranged on the rotation plane of said second moving contact (31), the fifth fixed contact (23) being arranged on the rotation plane of said third moving contact (32), the second and third moving contacts (31, 32) being fixed to the second operating element (8) in a mutual angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said fourth and fifth fixed contacts (22, 23).

10. The switchgear device according to one or more of claims 1 to 8, characterized in that it comprises a third bushing (43) which accommodates a third terminal (13), and in that said second disconnection unit (5) comprises a fifth fixed contact (23) which is connected to said third terminal (13), a second moving contact (31), a third moving contact (32) and a fourth moving contact (33) which are fixed to the second operating element (8), the third, fourth and fifth fixed contacts (21, 22, 23) being arranged respectively on the rotation plane of the second, third and fourth moving contacts (31, 32, 33), said moving contacts (31, 32, 33) being fixed to the operating element (8) in a mutual angular arrangement by virtue of which the third moving contact (32) cannot be coupled to the fourth fixed contact (22) when the second and/or fourth moving contacts (31, 33) are coupled to the corresponding fixed contacts (21, 23).

11. The switchgear device according to one or more of claims 7 to 10, characterized in that at least one of the moving contacts (31, 32, 33) that belong to the second disconnection unit (5) is constituted by a blade which is keyed on the second operating element (8) and is substantially

perpendicular to the rotation axis of said second operating element (8).

12. The switchgear device according to one or more of the preceding claims, characterized in that the interruption unit (4) comprises an interruption chamber which accommodates a fixed contact (14) and a moving contact (15), the longitudinal axis of said chamber being substantially aligned with the rotation axis of the second operating element (8).
13. The switchgear device according to claim 12, characterized in that the enclosure of said interruption chamber constitutes the second operating element.
14. The switchgear device according to one or more of the preceding claims, characterized in that the rotary operating element (93, 8) of the first and/or the second disconnection units (100, 5) are actuated by an electric rotary servomotor.

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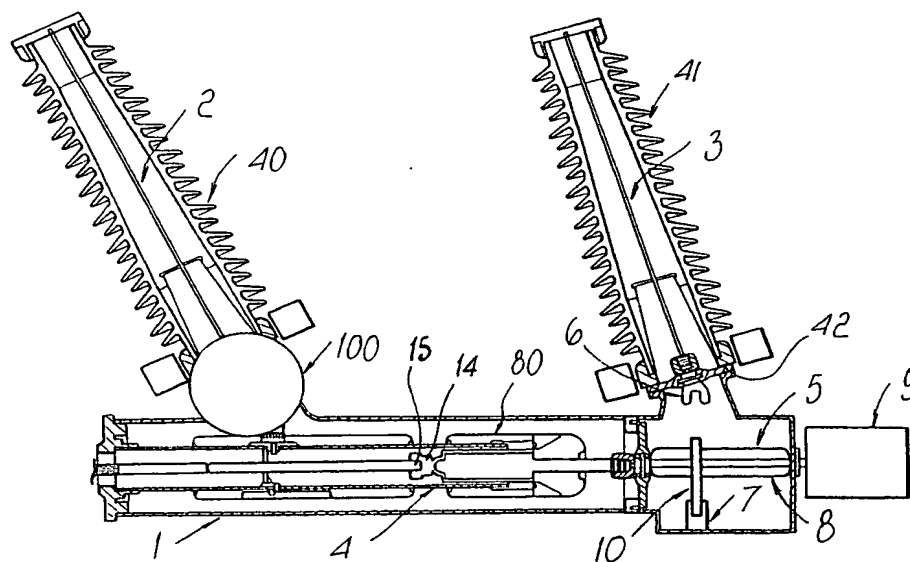
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(54) Title: GAS-INSULATED SWITCHGEAR DEVICE



(57) Abstract: A gas-insulated switchgear device which has a first bushing which accommodates a first terminal, a second bushing which accommodates a second terminal, a first enclosure which contains an interruption unit, and at least one first disconnection unit which has a first fixed contact electrically connected to the interruption unit and a second fixed contact at ground voltage, a first moving contact which is electrically connected to the first terminal and can be coupled to the first and second fixed contacts, the moving contact being fixed to a rotary operating element and rotating rigidly therewith, the fixed contacts that can be coupled to the moving contact lying on the rotation plane of the moving contact.

## GAS-INSULATED SWITCHGEAR DEVICE

DESCRIPTION

The present invention relates to a gas-insulated switchgear device for high- and medium-voltage applications, i.e. for voltages greater than 1000 Volt, having improved functions and characteristics. In particular, the device according to the invention, by virtue of its innovative structure, allows to optimize execution of the required electric switching, according to a solution which is at the same time simple, effective and compact.

It is known from the art that electric switching operations, for both interruption and disconnection, in gas-insulated circuit breaker and disconnector units are provided by virtue of the translatory motion of one or more moving contacts which can couple/uncouple with respect to corresponding fixed contacts. A significant drawback of known types of devices is the fact that the various switching operations, for example for disconnection on the input line or on the output line, are performed by means of dedicated components which are structurally separate and mutually distinct; in this way, the number of components used to implement the various switching operations is large and entails an increase in the space occupation and total volume of the device, with a consequent cost increase.

Furthermore, the necessary switching operations are performed by using actuation devices which comprise actuators of the mechanical or hydraulic type which are mechanically connected to a moving contact to be moved by virtue of appropriate operating elements.

The actuation devices of the known art generally require complicated kinematic systems to transmit motion to the moving contact. In particular, the switching operation for disconnection requires the coordinated movement of one or more moving contacts, so that the opening/closure of the disconnection contacts occurs in the intended sequence. This usually entails complicated coupling

mechanisms and/or complicated actuation and control systems, especially when disconnection occurs on multiple-bar systems.

In view of the mechanical complexity of the movement elements, maintenance interventions are necessary in order to maintain nominal behavior and therefore ensure repeatability of the movement, compensating for the variations caused by wear and aging of the system.

The aim of the present invention is to provide a gas-insulated switchgear device in which the electrical switching operations, particularly for disconnection, occur in a simple and easily controllable way.

Within the scope of this aim, an object of the present invention is to provide a gas-insulated switchgear device which has reduced mechanical complexity and a simplified structure with respect to the devices of the known art.

Another object of the present invention is to provide a gas-insulated switchgear device in which the switching operation for disconnection occurs by using and moving a reduced number of mechanical parts.

Another object of the present invention is to provide a gas-insulated switchgear device which has reduced dimensions and space occupation.

Another object of the present invention is to provide a gas-insulated switchgear device which is highly reliable, relatively easy to provide and at competitive costs.

This aim, these objects and others which will become apparent hereinafter are achieved by a gas-insulated switchgear device, having a first bushing which accommodates a first terminal and a second bushing which accommodates a second terminal, a first enclosure which contains an interruption unit, characterized in that it comprises at least one first disconnection unit which has a first fixed contact which is electrically connected to said interruption unit and a second fixed contact at ground voltage, a first moving contact which is electrically connected to the first terminal and can be coupled to said first and

second fixed contacts, said moving contact being fixed to a rotary operating element and rotating rigidly therewith, and in that the fixed contacts that can be coupled to said first moving contact lie on the rotation plane of said moving contact.

- 5 The device according to the invention can be of the segregated-phase or joined-phase type, for a single-bar or multiple-bar system, with single-pole or three-pole actuation.

In the device according to the invention, the disconnection maneuver therefore occurs by rotation of the moving contact about a rotation axis. By virtue of the  
10 rotation, the moving contact, which in practice constitutes a rotating extension of the first terminal, couples/uncouples with respect to one of the two corresponding fixed contacts, performing the switching for disconnection and grounding of the first terminal, or maintaining electrical continuity. The moving contact can furthermore assume an intermediate position for simply  
15 disconnecting the first terminal without grounding it. For these purposes, the moving contact and the fixed contacts are arranged in such a mutual position that the ends of the fixed contacts that must engage the end of the moving contact lie on the rotation plane traced by said end of the moving contact. For the sake of simplicity, when reference is made in the present invention to the  
20 relative position of the fixed contacts and of the moving contact, reference is always intended to the relative position of the ends of the fixed contacts and of the moving contact that can be coupled thereto.

By appropriately dimensioning the position of the fixed contacts and of the moving contact it is possible to minimize the volume and the space required by  
25 the disconnection unit and therefore by the entire device, maintaining easy execution of switching for disconnection.

Another advantage of the device according to the invention is the fact that it constitutes, in practice, a prefabricated module which can be easily transported

to the installation site.

Further characteristics and advantages will become apparent from the description of some preferred but not exclusive embodiments of a switchgear device according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a sectional view of an embodiment of a gas-insulated switchgear device for a single-bar system with single-pole actuation, according to the invention;

Figure 2 is a sectional view of an embodiment of a gas-insulated switchgear device for a two-bar system with single-pole actuation according to the invention;

Figure 3 is a detail view of a disconnection unit which can be used to disconnect the input line in the devices of Figures 1 and 2;

Figure 4 is a schematic view of the disconnection unit of Figure 3 during the disconnection and grounding maneuver of the input line;

Figures 5a-5d are schematic views of some output disconnection switching operations which can be performed with the device of Figure 2.

With reference to Figure 1, the device according to the invention comprises an enclosure 1 which contains an interruption unit 4 and an insulating gas, a first bushing 40 which accommodates a first electrical terminal 2, and a second bushing 41 which accommodates a second electrical terminal 3; the second bushing 41 is structurally connected to the enclosure 1 by means of a flange 42.

For example, the terminals 2 and 3 can be connected to a power line in input to and output from the switchgear device, respectively; alternatively, they can be connected to other electrical devices according to the applications.

In the device according to the invention, a first disconnection unit 100 is used between the input bushing 40 and the enclosure 1, at the base of the bushing 40 itself. As shown in detail in Figures 3 and 4, the disconnection unit 100

comprises an enclosure 99 which has a substantially spheroidal central portion and two mutually opposite ends 97 and 98 which are structurally connected to the enclosure 1 and to the first bushing 40, respectively. Said disconnection unit 100 furthermore comprises a first fixed contact 96, which is electrically  
5 connected to the interruption unit 4, a second fixed contact 95 at ground voltage, which is arranged on the spherical enclosure 99, and a first moving contact 94. The moving contact 94, which is electrically connected to the input terminal 2, is fixed to a rotary operating element 93 and rotates rigidly therewith. In particular, the rotary operating element 93 is constituted by a shaft 93 which is made of  
10 insulating material and is moved by actuation elements, for example an appropriately controlled electric motor, schematically designated by the reference numeral 90 in Figure 3. Advantageously, the insulating shaft 93 has an end which is connected to the input terminal 2 and acts as structural support for said terminal 2, allowing to avoid the use of additional supporting elements.

15 In a preferred embodiment, and according to a solution which is structurally and functionally simple and effective, the moving contact 94 is constituted by a blade which is keyed on the insulating shaft 93 and is arranged substantially at right angles to the rotation axis of said shaft; furthermore, the moving contact 94, the first fixed contact 96 and the second fixed contact 95 are arranged so that  
20 the ends of said fixed contacts lie on the plane traced by the rotation of the end of the moving contact 94. In normal operating conditions, the moving contact 94 is coupled to the fixed contact 96 so as to determine electrical continuity between the input terminal 2 and the interruption unit 4. Switching for disconnection and grounding of the input terminal 2 occurs by turning the shaft  
25 93; accordingly, the moving contact 94 rigidly coupled thereto couples to the fixed contact 95, thus providing the ground connection. In this manner, the switching operation is simple, with a limited number of components involved, and occurs according to an extremely compact constructive solution.

Another advantage of this solution consists of the fact that the disconnection unit 100, being arranged inside a containment enclosure, is in a position in which it is protected against atmospheric agents, thus allowing to reduce the necessary maintenance interventions; furthermore, the substantially spheroidal shape of the enclosure 99 allows to optimize the distribution of the electric field inside said disconnection unit 100, without requiring cumbersome constructive elements.

The rotation angle of the moving contact 94 between the position in which it is coupled to the fixed contact 96 and the position in which it is coupled to the fixed contact 95 can be between  $30^\circ$  and  $150^\circ$ , preferably between  $60^\circ$  and  $120^\circ$ , more preferably between  $80^\circ$  and  $100^\circ$ ; in particular, as shown in Figure 4, said rotation angle is approximately  $90^\circ$ . It is furthermore possible to arrange the moving contact 94 in an intermediate position in which it is coupled neither to the fixed contact 95 nor to the fixed contact 96, performing disconnection of the input terminal 2 without connecting it to the ground.

Advantageously, according to a preferred embodiment, the device according to the invention is provided with a second disconnection unit 5 which is positioned inside the enclosure 1 and is electrically connected to the interruption unit 4; as illustrated, the disconnection unit 5 is positioned on the opposite side of the interruption unit 4 with respect to the first disconnection unit 100. The second disconnection unit 5 comprises a third fixed contact 6 which is connected to the output terminal 3 and a fourth fixed contact 7 at ground voltage. In the case of Figure 1, the fixed contact 7 is connected to the enclosure 1 which is at ground voltage. The disconnection unit 5 comprises a second operating element, preferably a rotating shaft 8, which is moved by actuation elements represented schematically by the device 9, which can be for example an appropriately controlled electric motor.

A second moving contact 10, electrically connected to the interruption unit 4, is fixed to the shaft 8 and rotates rigidly with it. In the embodiment of Figure 1, the

second moving contact 10 is constituted by a blade which has a circular sector-shaped profile and is keyed on the shaft 8. The moving contact 10 and the third and fourth fixed contacts 6 and 7 are arranged so that the ends of said fixed contacts lie on the plane traced by the rotation of the end of the moving contact 10. In this case, the disconnection operation occurs by turning the shaft 8; accordingly, the moving contact 10 rigidly coupled thereto couples to the fixed contact 6 or 7, thus providing the line or ground connection of the output terminal 3, respectively. In Figure 1, the moving contact 10 is coupled to the fixed contact 7; the ground connection is therefore closed, while the output connection is open.

According to an alternative embodiment, not shown in the figure, it is possible to have two moving contacts which are fixed to the shaft 8, each being able to couple to a corresponding fixed contact. In this case, the fixed contact 6 lies on the rotation plane of one of the two moving contacts that can be coupled thereto, while the fixed contact 7 lies on the rotation plane of the other moving contact that can be coupled thereto. Furthermore, the two moving contacts are fixed to the shaft 8 in a relative angular position by virtue of which they cannot be simultaneously coupled to the fixed contacts 6 and 7. In this manner, by virtue of the rotation of the shaft 8, one obtains for example uncoupling between the fixed contact 6 and the first moving contact, followed by coupling between the fixed contact 7 and the second moving contact, thus providing ground disconnection. It is possible to proceed in the same manner when one wishes to open the ground disconnection contact and close the line contact.

A gas-insulated switchgear device for a two-bar system is now described with reference to Figure 2. As previously described, the device of Figure 2 comprises an enclosure 1 which contains a disconnection unit 5 and an interruption unit 4, and contains an insulating gas, a first bushing 40 which accommodates an input terminal 2, and a second bushing 41 which accommodates a first output terminal

11. Between the bushing 40 and the enclosure 1 there is a disconnection unit 100; the device furthermore comprises a third bushing 43 which accommodates a second output terminal 13. In this case, the disconnection unit 5 comprises a third fixed contact 21 which is connected to the output terminal 11, a fourth fixed contact 22 at ground voltage, and a fifth fixed contact 23 which is connected to the second output terminal 13. As in Figure 1, the fixed contact 22 is connected to the enclosure 1 which is at ground voltage. The disconnection unit 5 comprises a rotating shaft 8 which is moved by actuation elements which are schematically represented by the device 9, which can be for example an appropriately controlled electric motor.

A second moving contact 31, a third moving contact 32 and a fourth moving contact 33, electrically connected to the interruption unit 4, are fixed to the shaft 8 and rotate rigidly therewith. In the embodiment of Figure 2, the moving contacts 31, 32 and 33 are constituted by blades which have a circular sector-like profile and are keyed to the shaft 8. The moving contacts 31, 32, 33 and the fixed contacts 21, 22, 23 are arranged so that for each pair of contacts (21, 31), (22, 32) and (23, 33) the fixed contact lies on the rotation plane of the corresponding moving contact. Furthermore, the moving contacts 31, 32 and 33 are fixed to the shaft 8 with such an angular arrangement that the moving contact 32 cannot be coupled to the fixed contact 22 when the moving contact 31 and/or the moving contact 33 are coupled to the corresponding fixed contacts 21 and 23. Switching for disconnection on the output terminal side occurs by turning the shaft 8; accordingly, the moving contacts 31, 32 and 33 rigidly coupled thereto couple to the respective fixed contacts 21, 22 and 23. In Figure 2, the moving contact 32 is coupled to the fixed contact 22, while the moving contacts 31 and 33 are uncoupled from the respective fixed contacts 21 and 23; the ground connection is therefore closed, while the output connections are open.

The operating principle is shown schematically in Figures 5a-5d, in which the moving contacts are constituted by blades which are keyed to the shaft 8.

With reference to Figure 5a, a situation is shown in which the moving contact 32 is coupled to the corresponding fixed contact 22, while the moving contacts 31 and 33 are uncoupled from the corresponding fixed contacts. By turning the shaft 8 in the direction of the arrow, the ground contact is opened and then the moving contact 31 couples to the fixed contact 21, closing the connection toward the output terminal 11 (Figure 5b). By again turning the shaft 8 in the same direction, the moving contact 33 couples to the fixed contact 33 before uncoupling occurs between the contacts 21 and 31. In this manner, the connection toward the output terminal 13 is closed while the connection toward the terminal 11 simultaneously remains closed (Figure 5c). If the rotation of the shaft 8 is continued, it is possible to separate the contact 31 from the contact 21, opening the connection toward the terminal 11 and keeping closed the connection toward the terminal 13 (Figure 5d). It is furthermore possible to perform a switching operation, not shown, in which all the moving contacts are uncoupled from the corresponding fixed contacts so that the output terminals are disconnected without being grounded.

According to an alternative embodiment, not shown, the second disconnection unit 5 comprises just two moving contacts which are fixed to the shaft 8. The fixed ground contact 22 and one of the other two fixed contacts, for example the fixed contact 21, lie on the rotation plane of said moving contact, which can be coupled alternately to the fixed contact 21 or to the fixed contact 22; the third fixed contact 23 lies on the rotation plane of the other moving contact and can be coupled thereto. The two moving contacts are fixed to the shaft 8 with a mutual angular arrangement by virtue of which they cannot be simultaneously coupled to the contacts 22 and 23, while their relative angular position is such that they can be simultaneously coupled to the fixed contacts 21 and 23.

As previously indicated, in both embodiments of Figures 1 and 2, the switchgear device according to the invention comprises an interruption unit 4 which has an interruption chamber which accommodates a fixed contact 14 and a moving contact 15, the longitudinal axis of the interruption chamber being substantially aligned with the rotation axis of the second operating element 8. In this case, the opening/closure switching of the interruption unit 4 is performed by means of a translatory motion of the moving contact of the interruption unit along the longitudinal axis of the device, while disconnection on the output terminal side occurs by rotation of the moving contacts of the disconnection unit 5 about said longitudinal axis.

According to a particular embodiment, not shown, the operating element of the disconnection unit 5 is constituted by the enclosure 80 of the interruption chamber. In this case, the moving contacts of the second disconnection unit 5 are keyed to the outer surface of the interruption chamber, which can rotate with respect to the enclosure 1 of the device. The movement is applied by actuation elements, for example an appropriately controlled electric motor. The mutual arrangement of the fixed contacts and of the moving contacts is similar to the one shown in Figures 1 or 2, depending on whether a single- or two-bar system is provided. By using this technical solution, the device according to the invention is particularly compact, since the space occupied by the disconnection unit 5 is distributed inside the enclosure 1 along the interruption chamber.

As mentioned, the disconnection elements are moved by virtue of suitable actuation means, preferably constituted by a controlled electric motor. In particular, it has been found that the use of a servomotor, both for the first disconnection unit 100 and for the second disconnection unit 5, as well as for the movement of the moving contacts of the interruption unit 4, allows considerable advantages in terms of switching precision and speed. Alternatively, it is possible to use mechanical or hydraulic actuation means. Manual actuation

means can also be provided alternatively, or in addition, to the above described actuation means, particularly to perform emergency manual switching.

The device according to the invention can be of the type with single-pole actuation, in which actuation means are provided on each individual phase in order to perform switching for disconnection; alternatively, it can be of the type with three-pole actuation, in which the energy for switching for disconnection on the three phases of the device is provided by a single actuation means which is mechanically coupled to the disconnection units of each individual phase.

The gas-insulated switchgear device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with technically equivalent elements. In practice, the configurations considered, so long as they are compatible with the specific use, as well as the individual components, may be any according to the requirements and the state of the art.

CLAIMS

1. A gas-insulated switchgear device, having a first bushing which accommodates a first terminal and a second bushing which accommodates a second terminal, a first enclosure which contains an interruption unit,  
5 characterized in that it comprises at least one first disconnection unit which has a first fixed contact which is electrically connected to said interruption unit and a second fixed contact at ground voltage, a first moving contact which is electrically connected to the first terminal and can be coupled to said first and second fixed contacts, said moving contact being fixed to a  
10 rotary operating element and rotating rigidly therewith, and in that the fixed contacts that can be coupled to said first moving contact lie on the rotation plane of said moving contact.
2. The switchgear device according to claim 1, characterized in that said first disconnection unit comprises an enclosure which has a substantially  
15 spheroidal central portion and two mutually opposite ends which are structurally connected respectively to said first enclosure and to said first bushing.
3. The switchgear device according to claim 2, characterized in that said second fixed contact at ground voltage is arranged on the spheroidal portion.
- 20 4. The switchgear device according to claim 1, characterized in that the first moving contact is constituted by a blade which is keyed on said operating element and is substantially perpendicular to its rotation axis.
5. The switchgear device according to one or more of the preceding claims, characterized in that said first moving contact can be turned between a first  
25 position for coupling to the first fixed contact and a second position for coupling to the second fixed contact, the rotation angle between the first position and the second position being between 30° and 150°, preferably between 60° and 120°, more preferably between 80° and 100°.

6. The switchgear device according to one or more of the preceding claims, characterized in that the rotary operating element comprises a shaft made of insulating material, said shaft having an end which is connected to the first terminal and being suitable to support it structurally.
- 5 7. The switchgear device according to claim 1, characterized in that it comprises a second disconnection unit which is arranged inside said first enclosure and comprises a third fixed contact which is connected to the second terminal and a fourth fixed contact which is at ground voltage, at least one second moving contact which can be coupled to at least one of said  
10 third and fourth fixed contacts and is electrically connected to said interruption unit, said second moving contact being fixed to a second rotary operating element and rotating rigidly therewith, the fixed contact that can be coupled to said second moving contact being arranged on the rotation plane of said second moving contact.
- 15 8. The switchgear device according to claim 7, characterized in that said second disconnection unit comprises a single moving contact and in that said third and fourth fixed contacts lie on the rotation plane of the moving contact.
9. The switchgear device according to claim 7, characterized in that said  
20 second disconnection unit comprises a second moving contact and a third moving contact which are fixed to said second operating element, and in that said third and fourth fixed contacts lie respectively on the rotation plane of said second and third moving contacts, which are fixed to said second operating element in a relative angular arrangement by virtue of which they  
25 cannot be simultaneously coupled respectively to said third and fourth fixed contacts.
10. The switchgear device according to one or more of claims 7-9, characterized in that it comprises a third bushing which accommodates a third terminal and

in that said second disconnection unit comprises a fifth fixed contact which is connected to said third terminal, a second moving contact and a third moving contact which are fixed to the second operating element, said third and fourth fixed contacts being arranged on the rotation plane of said second moving contact, the fifth fixed contact being arranged on the rotation plane of said third moving contact, the second and third moving contacts being fixed to the second operating element in a mutual angular arrangement by virtue of which they cannot be simultaneously coupled respectively to said fourth and fifth fixed contacts.

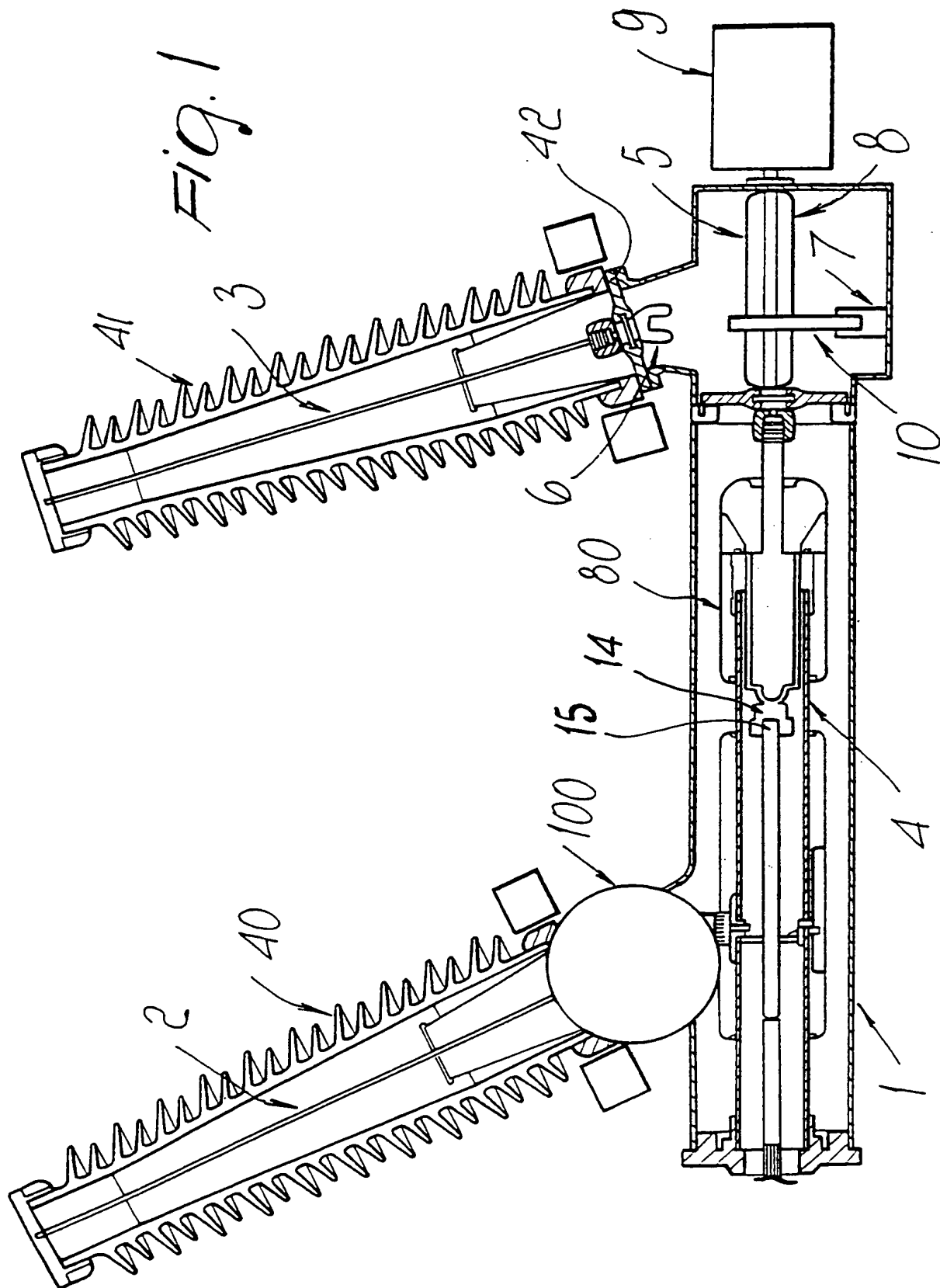
11. The switchgear device according to one or more of claims 1 to 9, characterized in that it comprises a third bushing which accommodates a third terminal, and in that said second disconnection unit comprises a fifth fixed contact which is connected to said third terminal, a second moving contact, a third moving contact and a fourth moving contact which are fixed to the second operating element, the third, fourth and fifth fixed contacts being arranged respectively on the rotation plane of the second, third and fourth moving contacts, said moving contacts being fixed to the operating element in a mutual angular arrangement by virtue of which the third moving contact cannot be coupled to the fourth fixed contact when the second and/or fourth moving contacts are coupled to the corresponding fixed contacts.

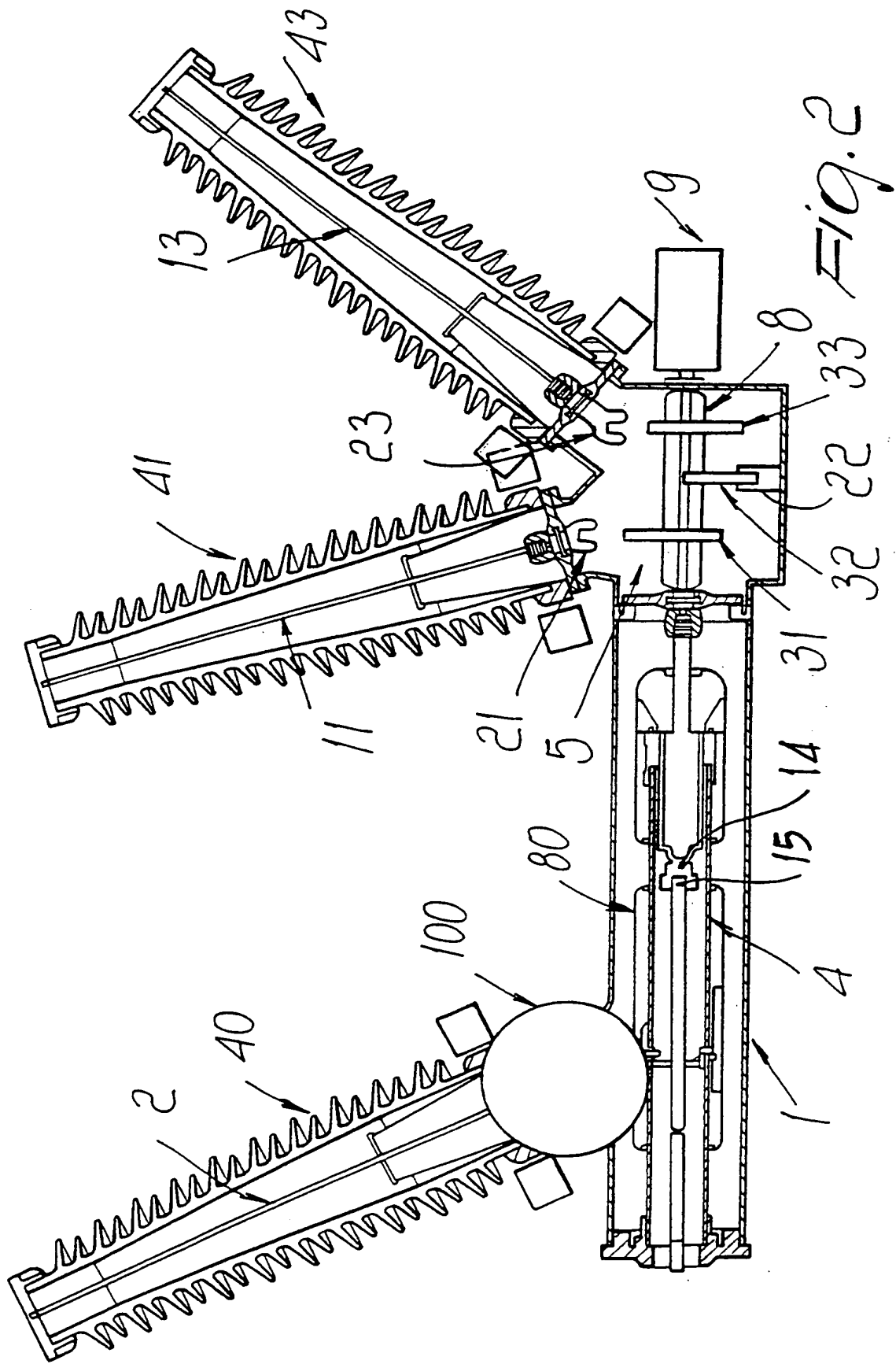
12. The switchgear device according to one or more of claims 8 to 11, characterized in that at least one of the moving contacts that belong to the second disconnection unit is constituted by a blade which is keyed on the second operating element and is substantially perpendicular to the rotation axis of said second operating element.

13. The switchgear device according to one or more of the preceding claims, characterized in that the interruption unit comprises an interruption chamber

which accommodates a fixed contact and a moving contact, the longitudinal axis of said chamber being substantially aligned with the rotation axis of the second operating element.

14. The switchgear device according to claim 13, characterized in that the enclosure of said interruption chamber constitutes the second operating element.
15. The switchgear device according to one or more of the preceding claims, characterized in that the rotary operating element of the first and/or the second disconnection units are actuated by an electric rotary servomotor.





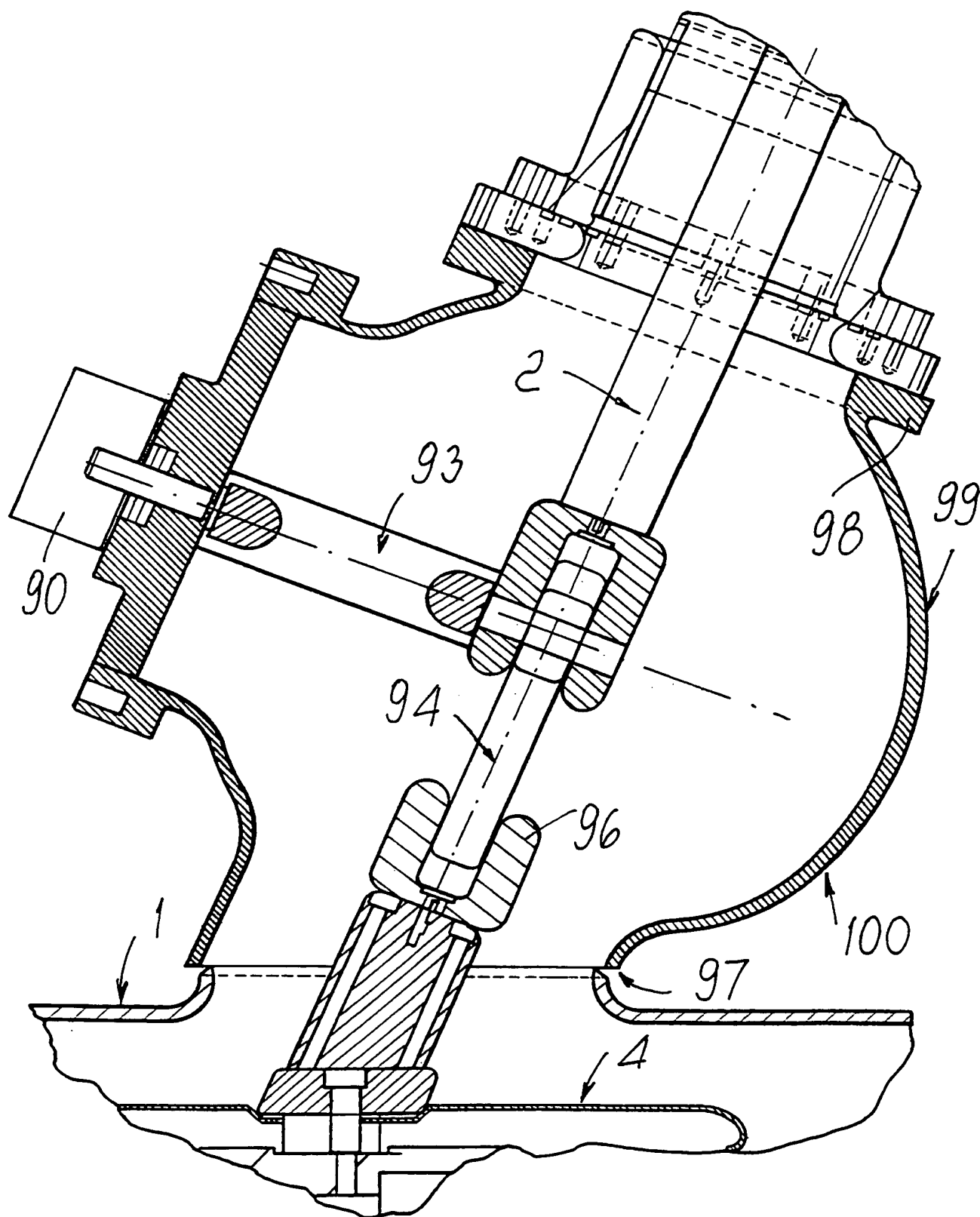


FIG. 3

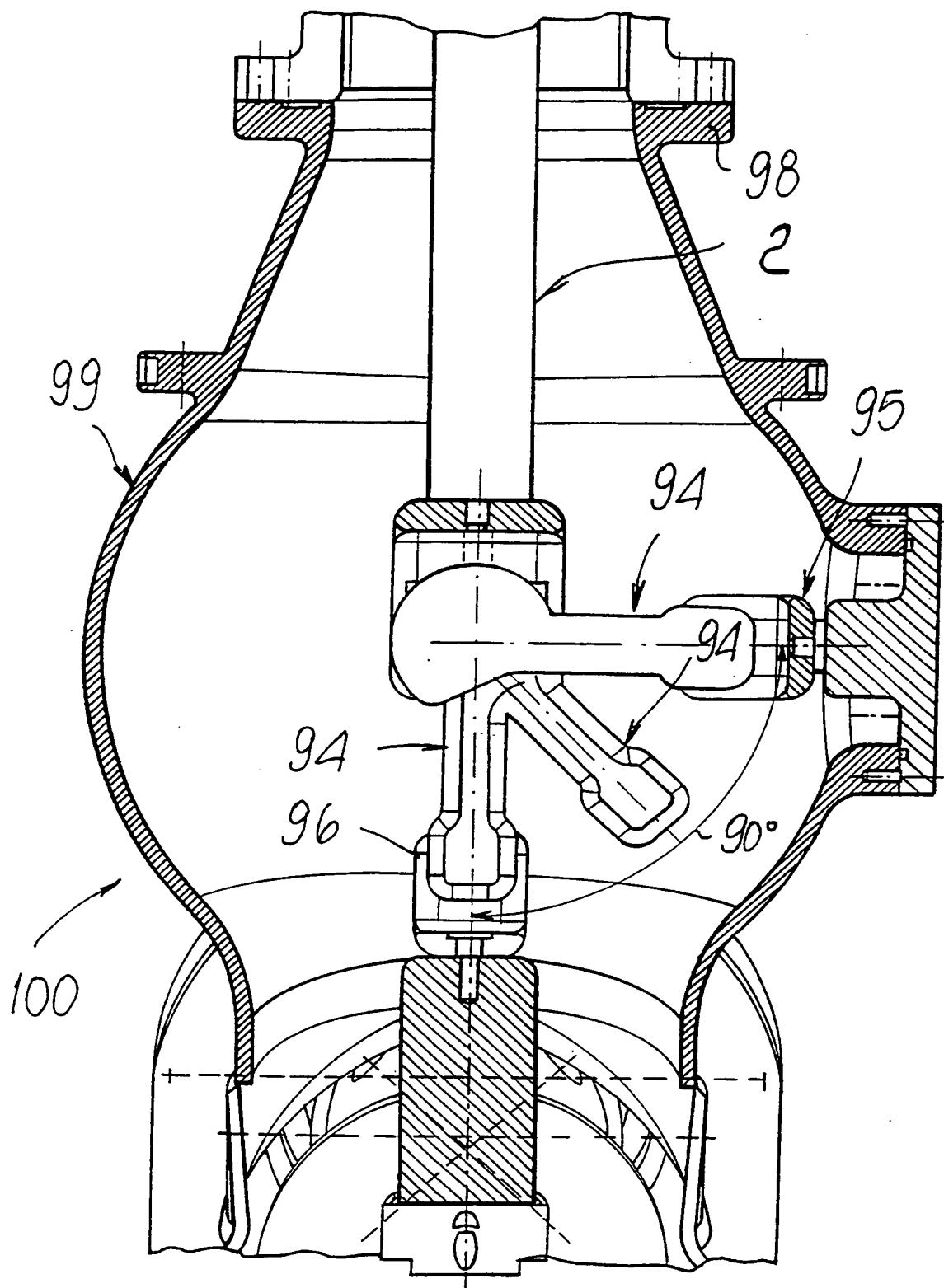
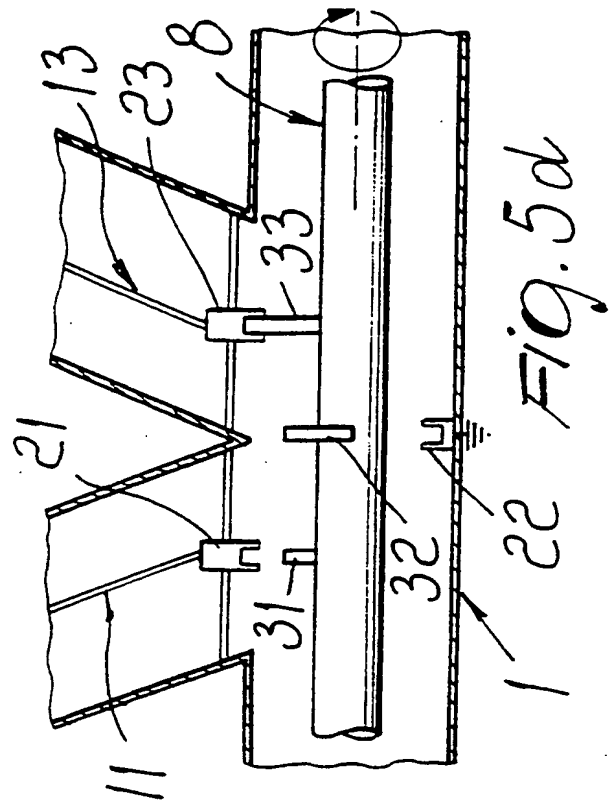
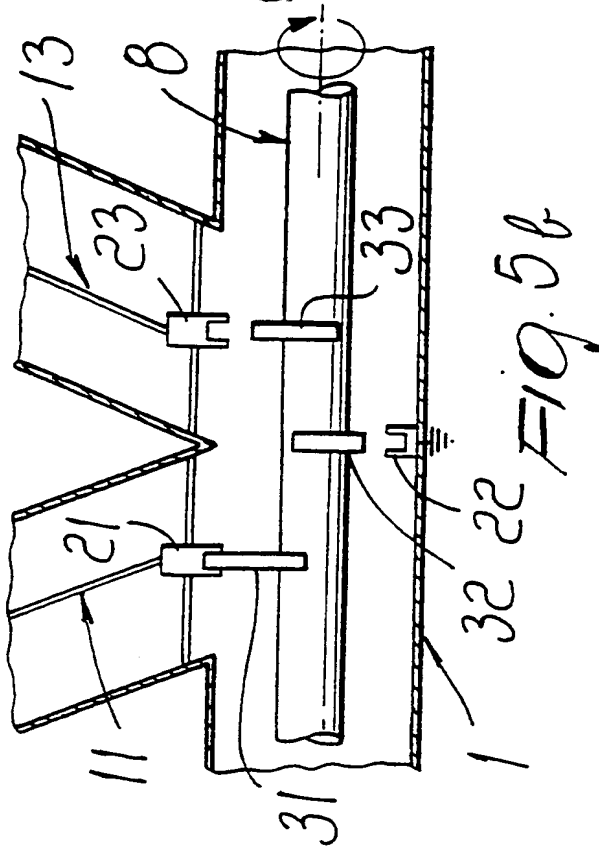
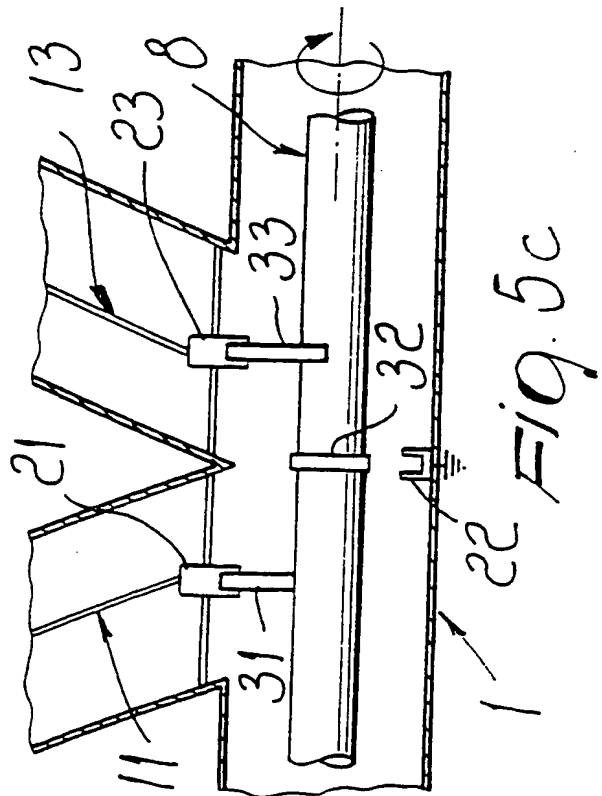
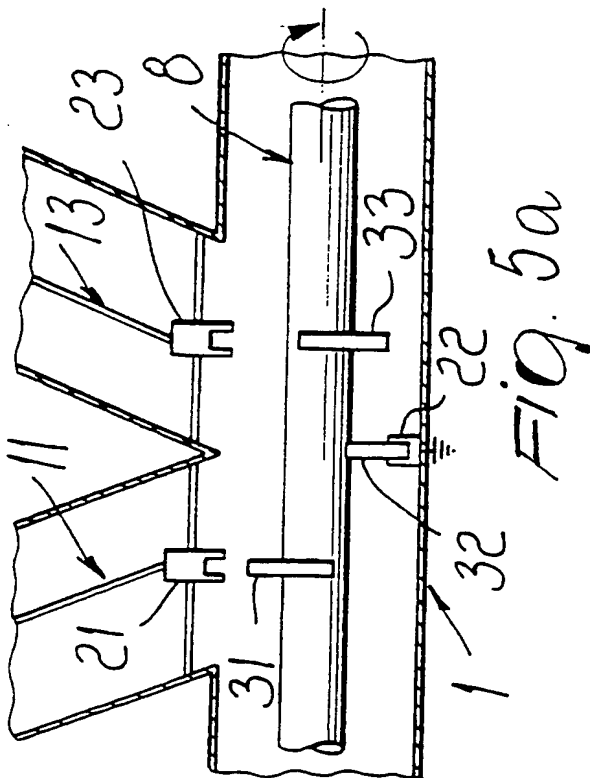


FIG. 4



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/08842

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H02B13/035

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 297 00 930 U (SIEMENS AG) 3 April 1997 (1997-04-03)	1-6
Y	page 1, line 20 -page 2, line 24  page 3, line 1 - line 16; figure ---	7,8, 12-15
Y	US 5 796 060 A (HOEGG PETER ET AL) 18 August 1998 (1998-08-18) column 6, line 53 -column 7, line 10; figures 1-6 ---	7,8, 12-15
A	US 4 109 124 A (BOERSMA RINTJE ET AL) 22 August 1978 (1978-08-22) column 1, line 12 - line 53; figures -----	2,3



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

22 December 2000

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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